# The Clarinet Mouthpiece

## In Relation to Tone and Pitch

By Arlie Richardson

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**LEBLANC EDUCATIONAL**

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## In Relation to Tone and Pitch

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Clarinet tone quality, as produced by our students, is generally agreed to be influenced by several factors. Embouchure, reed, and mouthpiece certainly have a great deal to do with quality and pitch. The instrument in relation to actual tone quality as produced by the student—herein thought of as the majority of the players in our elementary and secondary schools and often in college—is clearly explained in the illuminating and scientific experiment, "Analyses of Tones of Wooden and Metal Clarinets," as recorded by the Journal of the Acoustical Society of America, May, 1947.

Embouchures vary considerably because of physical make-up. We can illustrate to our students how lips, chin, tongue, and teeth should be held while blowing. Yet there is no means of actually measuring the tension direction to be applied to the chin and lip muscles, the pressure on the mouthpiece and reed, as well as the exact degree of air pressure to be exerted on the reed at varying pitches. Thus this factor remains inconsistent and can perhaps never be scientifically measured.

Reeds are a constant source of worry. Manufactured under many brands of various strengths, cuts, grains, and colors, a reliable method of selection, except actually playing them, is yet to be found. There are repeated experiments being carried out in the production of plastic or composition reeds, and with the scientific knowledge available it is certain that a substitute for nature's product will be found. As yet, however, reeds remain an inconsistent factor in tone production.

The mouthpiece is the one item that can be measured and produced so as to play exactly alike, all other factors being equal. The exact measurements or qualities can probably never be agreed upon for playing artists or reed majors, but if a compromise for students can be found, our educational processes can be simplified. Leading educators tell us that a medium length facing and tip is best for students. In recording and observing many national and regional bands composed of students selected from areas all over the United States, I have found that the chairs held after auditions are in direct ratio to the type of mouthpiece played, and that as few as two of forty-eight players played anything but a medium facing. Of course more is needed than

a correct mouthpiece, but it is interesting to note the preponderance of fine student players who succeed through its use.

*Materials*

The tradition that rubber, plastic, glass, or metal mouthpieces produce a vastly different tone quality is gradually becoming less accepted. If the experiment as recorded by the Acoustical Society of America is correct, we may assume that the experiment as outlined could well apply also to the mouthpiece—a very short portion of the over-all harmonic producing tube. Some difference in blowing can be noticed by the playing artist (not the student) when comparing rubber with other materials, as rubber is rougher and offers slightly more resistance; for which the maker, by the way, can compensate in other specifications.

It is interesting to note that several years ago when a manufacturer ran a test, using several playing artists, a plastic mouthpiece was greased and polished to look like rubber. This panel of players, who before were very prejudiced against plastic, chose this mouthpiece as being the best of those tested. This perhaps typifies the psychological factor that influences our thinking—the differences through sensation derived from contact.

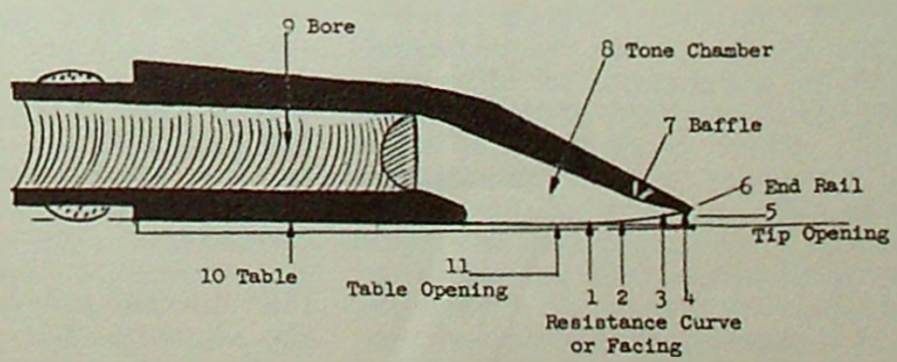
*Formation*

Molded mouthpieces are made by placing the material in a casting, which is then properly treated through heat. The material must take the exact form of the casting. This is especially true when plastic is injected under pressure, allowing only the required amount to enter each die. Thus, in molding, the bore and tone chamber can be made exact, leaving only the resistance curve, tip rail, baffle and tip opening to be completed by hand.

Rod rubber mouthpieces are made of prepared bar stock. Air holes may sometimes be found in the block, which are then filled with a foreign substance. All interior specifications are then made by drilling, gouging, and scraping. Rod rubber mouthpieces can be made very accurately if sufficient time and workmanship are spent in meeting exact tolerances. Naturally, each additional operation increased the possibility of variances, and also makes the cost higher. Assuming that a mouthpiece produces sound because of its construction, how are the specific tolerances arrived at? After the "casing" is removed from the die, a machine, with its abrasives guided by a template made to specifications, cuts the curve and table (No. 1, 2, 3, 4, and 10 in the diagram). In preparing a facing, this curve is plotted on the mouthpiece by use of

## MOUTHPIECE NOMENCLATURE

How can the educator select a proper student mouthpiece? The diagram below shows eleven component parts that are important, many of which the layman can distinguish.




CLARINET MOUTHPIECE - CROSS SECTION

several "feeler gauges" laid on a flat glass marked in half millimeters or fractions of an inch.

The distance that these gauges of various thickness, starting with .0015 inch (similar to a cigarette paper), slide under the facing gives the plot of the curve, starting at the table and extending to the tip.

*Warpage*

A mouthpiece is warped when the facing curve varies in length at one or more places on the side rails. This can be caused by carelessness of the maker or can be brought about by extreme heat and/or ligature pressure. The coefficient of expansion of good quality rubber and plastic is quite similar. A plastic mouthpiece was played constantly for 15 years with no change in the facing. Glass or crystal mouthpieces, when accurately made, will always play the same but are especially subject to breakage, which can be a factor when purchased for school use.

How important is warpage? For the playing artist it is not too important. I had the opportunity of measuring the personal mouthpieces of two of our fine artist teachers—both were warped. The mature player adjusts reed and embouchure to suit his playing needs. For the young player, it is best to start with a straight facing so that the problem of the necessary adjustment will not impede his progress.

We may conclude that any mouthpiece materials will work well, provided they are of good quality and constructed with exact specifications.

The eleven construction details shown in the diagram all influence the blowing qualities of the mouthpiece. Great variation of any one specification can materially change the blowing quality, discernible to even a young student. Slight variations will be compensated for by the mature player. While mathematically speaking there can be 1,108,480 possible variations of 12 measurements, luckily some of them do not greatly affect the quality.

*The Resistance Curve and Tip Opening*

The resistance curve, or facing, is shown in the diagram as #1, 2, 3, 4. These are important specifications and measurable by the teacher. Procure from your tool, hardware, or auto supply store steel or brass shim stock, 1 inch wide, in gauges of .0015, .010, .024, and .034 inch. Place mouthpiece table down on flat surface (glass preferred) and slip one feeler gauge at a time under the facing. Mark and measure each distance. If the mouthpiece is warped, the gauge will not be straight when it stops.

If the teacher wishes to find a duplicate to a mouthpiece in use that blows properly, the feeler gauges make comparison of the facings quite easy. Simply insert one gauge at a time under each facing, mark the length and compare.

The tip opening (#5) is an important specification—that opening between the tip end of the mouthpiece and reed. Homemade tools are difficult to use here, but .0431 inches in height would indicate a medium opening. There is close correlation between the number 4 facing measurement and the tip opening, so an estimate of the height is possible with the .034 feeler gauge. A close tip produces greater resistance and requires a stiff reed, and an open tip has little resistance, is more difficult to control tonally and pitchwise, will have a "tubby" quality with little projection and requires a soft reed.

*End Rail, Baffle and Tone Chamber*

You will find that the end rail and side rails are well in proportion, the end rail (#6) being less than 1/32nd of an inch in width. The end rail is especially important in reed response. All rails must be perfectly smooth, with no evidence of roughness. The end rail is made by hand, cut to the proper width, then leveled off slightly to meet the convex baffle (#7) in the core of the tone chamber (#8). If the baffle is too high the mouthpiece will squeak—if too low, it will

"grunt" or drop into a lower register.

The tone chamber may have straight or tapered walls, going down to the core, making a proportional inclusion for the air column to pass through. A slight variance in size affects the resistance, while a very large tone chamber will raise the pitch. One manufacturer has mouthpieces available in four sizes of tone chambers, and with fluted bores, and even a third rail. I feel that students should not use deviations from normal construction. Innovations may possibly benefit the playing artist, but will only make for confusion and undue adjustment with the student.

*Bore, Table, Barrel Joint and Pitch*

The bore (#9), going from the tone chamber to the clarinet barrel, is a critical spot in specifications. The bore is tapered slightly —usually averaging only .031 inch. While this taper is not great, tests indicate that a variance of more than .008 inch may show an appreciable pitch variation—provided the tone chamber has not been proportioned accordingly. It is found in many mouthpieces that the bore on identical models varies considerably and this, when combined with an ill-adjusted resistance curve, tip opening, tone chamber or baffle, results in a totally different response from the same model. As to matching this bore with the clarinet barrel, a slight variance in bore does not change relative pitch a great deal unless the other specifications are not proportioned correctly.

The table (#10), that flat part upon which the reed is secured, may be either perfectly flat, or concave to .0005 inch about halfway back. Either specification is permissible. The bending of the reed under pressure will have no effect on the student's tone production. The table opening (#11) may vary in length by as much as 1/4 inch. The accomplished player often finds that the larger opening allows for more tone possibilities.

An extremely long facing with open tip will play flat, not only because the reed has a larger amplitude of vibration, but because of the excessive embouchure pressure required to hold the reed in proper playing position. An arbitrary statement that all long, open facings play flat could be disproved by compensating for it in the tone chamber and bore.

Few properly proportioned mouthpieces vary the pitch appreciably, but many intonation problems do result from the barrel joint. No extremes in length of barrel can be used if we are to have all registers on pitch. As shortening the length by 1/8 inch sharpens the throat tones 1/4 of a semitone, and the low E by only 1/12 of a semitone, it is evident that excessively short or long barrels will raise havoc with other intervals. It is not wise to have young players start with a shortened barrel in order to play up to pitch. In order that the student play intervals correctly, more stress must be on the proper medium mouthpiece and reed, with a firm embouchure.

*Conclusion*

More and more educators are becoming aware of the importance of the mouthpiece in relation to tone quality. They are now more secure in the knowledge that it is possible to make a wise selection without falling prey to the disease, "mouthpiecitis," where one eternally searches for and changes mouthpieces in looking for something that will do the work—this is not the answer.

It becomes more and more evident that school clarinet sections with the same mouthpiece specifications (obtainable only in most cases by actual measurements) will be superior, other things being equal. Not only will the tones have a similar quality (when blown with the correct embouchure), but proper reeds will be more easily obtainable. It is well worth the time and effort of every director to actually measure and check every mouthpiece and discard those that are extreme or ill-constructed. The results in better intonation and similar quality will astound your critics. A well-known clinician states that a 50 to 75 per cent improvement is the usual immediate result. Progress is in order!

# CLARINET MOUTHPIECE GAUGE CHART

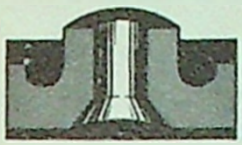
CONTROL SECTION (nearest table)

| Gauge | Length (Short) | Possible Result | Length (Medium) | Possible Results | Length (Long) | Possible Result |
|---|---|---|---|---|---|---|
| .0015 | 9/16 in. or less | Less "bite" used. Less power and projection. | 10/16 in | Firm embouchure produces projection, brilliant tone. | 11/16 in. or more | Long "bite used. Control difficult. Requires strong embouchure. |
| .010 | 6/16 in. or less | Stuffy. | 7/16 in. | | 8/16 in. or more | Tiring. Blows harder. "Rough" Tone. |

VENT SECTION (nearest tip)

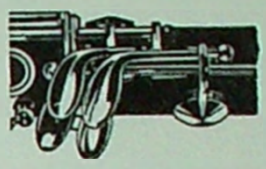
| | (Close) | | (Medium) | | (Open) | |
|---|---|---|---|---|---|---|
| .024 | 3/16 in. or less | Great resistance. Small tone. Stuffy. Requires stiff reed. | 4/16 in. | Some resistance. Projected tone in all ranges. | 5/16 in. or more | Little resistance. Control difficult. Requires strong embouchure. Soft reed. |
| .034 | 3/32 in. or less | | 2/16 in. | Brilliant fluid tone. Medium reed. | 5/32 in. and up | |

Combinations of any of the above measurements may make a difference in blowing qualities. Great differences in tone chamber and/or more can nullify results.

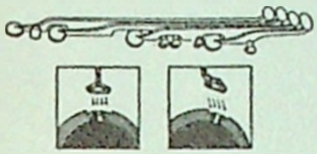


**Flare-Cut Tone Holes** permit use of smaller tone holes for easier fingering, instant response—helps prevent squeaking.

**Anchored Posts** maintain rigid key alignment—posts can't turn, assure dependable performance.

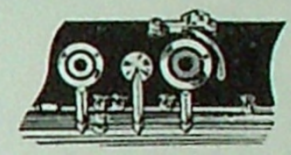


**"Action-Poised Touch"** results from use of extra hinges and posts at strategic points. Gives "live", balanced feeling to keys.



**Jump Keys** are side trill keys that jump over intervening tone holes to permit straight-in-line action. Helps stop "bubbling", prolongs pad life.

**Power-Forged Keys** of nickel-silver are extra strong—almost impossible to bend, break or put out of regulation.



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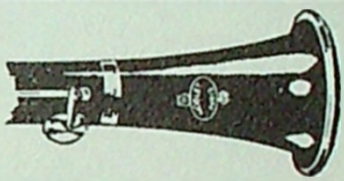

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